CLAIMS

1. Apparatus for duplex printing comprising:

a first impression roller on which a first side of a sheet having a leading edge and a trailing edge is printed referenced to the leading edge;

a second impression roller on which a second side of the sheet is printed; and

a transport system that removes a printed sheet from the first impression roller and transports it to the second impression roller, the transport system comprising a perfector including an element rotating about an axis, the element receiving the sheet and griping the sheet simultaneously along both the leading and trailing edges thereof, which rotating element turns the sheet over and transfers the sheet, trailing edge first, towards the second impression roller.

2. Apparatus according to claim 1 wherein the perfector transfers the sheet with the trailing edge registered to the leading edge.

3. Apparatus according to claim 1 or claim 2 wherein the perfector comprises a first array of suction cups that grips the sheet adjacent the leading edge and a second array of suction cups that grips the sheet adjacent the trailing edge.

4. Apparatus according to claim 3 wherein the distance between the first and second suction cup arrays is adjustable to accommodate different size sheets.

5. Apparatus according to claim 3 or claim 4 wherein the perfector comprises a shaft to which the arrays of suction cups are mounted.

6. Apparatus according to claim 5 wherein the first and second arrays of suction cups are respectively connected via first and second internal channels in the shaft to at least one vacuum system that controls aspiration of suction cups in the arrays.

7. Apparatus according to claim 6 wherein the first and second channels respectively have first and second orifices on the surface of the shaft and wherein the first orifice is displaced from the second orifice along the axis of the shaft.

8. Apparatus according to claim 7 and comprising first, second and third annular bearings mounted to the shaft, wherein each bearing has an inner and outer race that sandwiches a plurality of rollers and a grease seal providing a seal between the inner and outer race.

9. Apparatus according to claim 8 wherein the first orifice is located between the first and second bearings and the second orifice is located between the second and third bearings.

10. Apparatus according to claim 9 wherein the shaft is sealed to the inner race of each bearing.

11. Apparatus according to claim 10 and comprising a housing mounted on the bearings, the housing having a housing wall formed with first and second through holes and having a cavity defined by a cavity surface, and wherein the first through hole is located between the first and second bearings and the second through hole is located between the second and third bearings.

12. Apparatus according to claim 11 wherein the outer race of each bearing is sealed to the cavity wall.

13. Apparatus according to claim 12 wherein the first and second through holes are connected to the at least one vacuum system via first and second pressure hoses respectively and wherein the suction cups of the first and second suction cup arrays aspirate when the at least one vacuum system respectively draws air through the first and second pressure hoses.

14. Apparatus according to any of claims 1-13 wherein the perfector comprises at least one sheet support surface on which the sheet lies when it is held by the perfector.

15. Apparatus according to claim 14 and comprising a fan that creates airflow that presses the sheet flat to the at least one sheet support surface.

16. Apparatus according to any of the preceding claims wherein the perfector rotates in a first direction when removing the sheet from a preceding roller and rotates in an opposite direction when it passes off the sheet to a following roller.

17. A sheet transport system for a printer that receives a sheet from an impression roller of the printer on which a first side of the sheet is printed referenced to a leading edge of the sheet and if the sheet is to be printed on its second side, turns the sheet over and returns the sheet to the impression roller, comprising:

a conveyor belt that feeds a sheet placed thereon to the impression roller;

a perfector that removes a sheet from the impression roller after a first side of the sheet is printed and if a second side of the sheet is to be printed, places the sheet on the conveyor belt, and if a second side is not to be printed, moves the sheet towards a printer output tray, the perfector comprising:

first and second brackets independently rotatable about a same axis;

a plurality of suction cups mounted on each of the first and second brackets;

at least one sheet support surface mounted on each bracket; and

a system that rotates the brackets sequentially, one after the other to remove printed sheets from the impression roller and either place a removed sheet on the conveyor or move the sheet towards the output tray.

18. A sheet transport system according to claim 17 wherein the at least one support surface mounted on a bracket is a relatively long narrow surface defined by a plane curve whose plane is perpendicular to the axis about which the first and second brackets rotate and wherein the radial distance from the axis to a point on the curve decreases as the distance of the point from the bracket increases.

19. A sheet transport system according to claim 18 wherein the at least one support surface of the first bracket is axially displaced from the at least one support surface of the second bracket.

20. A sheet transport system according to any of claims 17-19 and comprising a fan that creates airflow that presses a sheet placed on the conveyor belt to the conveyor belt surface.

21. A sheet transport system according to any of claims 17-20 wherein the perfector rotates in a first direction when removing the sheet from a preceding roller and rotates in an opposite direction when it passes of the sheet to a following transport element.

22. An apparatus for transmitting vacuum to a device mounted on a rotating shaft comprising:

first and second annular bearings mounted to and sealed to the shaft so that there is a space between the bearings, wherein each bearing has an inner race and an outer race that sandwich a plurality of rollers and at least one seal between the inner and outer races;

a housing having a housing wall formed with a through hole, said housing wall together with said bearings forming a cavity that surrounds the shaft and communicates with said through hole, the housing wall being sealed to the outer race of each bearing;

wherein said shaft is formed with an internal channel having a first aperture that communicates with said cavity and a second aperture communicating with said device; and

wherein the bearings are grease sealed bearings and wherein the grease seal acts as a vacuum seal for the cavity.

23. Apparatus according to claim 22 and comprising a source of vacuum that communicates with the through hole to produce a vacuum in the cavity and thereby to transmit vacuum to the device.

24. Apparatus according to claim 23 and comprising a third grease sealed annular bearing that forms together with the second bearing and the housing wall an additional cavity that surrounds the shaft, wherein the bearing has an inner race and an outer race sealed to the shaft and housing respectively.

25. Apparatus according to claim 24 wherein the housing wall is formed with an additional through hole that communicates with the additional cavity.

26. Apparatus according to claim 25 wherein the shaft is formed with an additional internal channel that communicates with the additional cavity and with an additional device mounted to the shaft.

27. Apparatus according to claim 26 wherein the source of vacuum communicates with the through hole and the additional through hole to control vacuum in the cavity and the additional cavity independently of each other and thereby to independently control vacuum transmitted to the device and the additional device.

28. Apparatus according to any of claims 22-27 wherein at least one of the inner and outer races are seal to the shaft or housing by an o-ring seal.